2. The “Material Turn” in Journalism Studies Meets Device Perspectives From Digital Social and Media Research

As outlined in the Introduction, this thesis proposes a news device approach to studying the role of digital devices in news and journalism practices. This approach translates difficult but important questions about impact in the relations between news and digital media into a focus on the role of digital objects and devices in enacting[5] various aspects of news work in particular contexts. This outlook combines insights and perspectives from two emerging bodies of research: on the one hand, recent STS-inspired studies of journalism; and, on the other hand, device-centred approaches developed in digital social and media research.

In this chapter I discuss these two bodies of work that I draw on and contribute to. I propose the notion of news device as a way to think through how these approaches can be combined and brought to bear on the study of digital news making, circulation and use. Both areas of work are inspired by approaches from science and technology studies (STS), and particularly from the approach to understanding the making of science and technology developed in actor-network-theory (ANT). STS, as one handbook puts it, "is an interdisciplinary field that investigates the institutions, practices, meanings, and outcomes of science and technology and their multiple entanglements with the worlds people inhabit, their lives, and their values" (Felt, Fouché, Miller, & Smith-Doerr, 2017, p. 1). To understand these areas, ANT proposes an approach that "maps relationships among material entities and artifacts, human actors, and the ideas or symbols associated with them as 'heterogeneous' and open sociotechnical networks" (Lievrouw, 2014, p. 29).

In the next section I introduce recent socio-technical approaches to the study of journalism, on which my approach draws. The aim is not to provide a comprehensive review of this body of work but rather to introduce aspects

5 The notions of "enactment" or "performativity" which are used throughout this thesis are linked to actor-network-theory (see, e.g., Latour, 2005b). As a theory of action (as opposed to a theory of actors), ANT sees socio-technical relationality as not posited between pre-existing entities, but sees these entities as the outcomes or effects of ongoing processes of networked (inter-)action or assembling (Suchman, 2014). According to Law (2004), enactment or performance refer to "the claim that relations, and so realities and representations of realities (or more generally, absences and presences) are being endlessly or chronically brought into being in a continuing process of production and reproduction, and have no status, standing, or reality outside those processes" (p. 159).

that inform the news device perspective: the interest in accounting for the materiality of cross-media news work, the conceptualisation of this work as socio-technical practices, and the identification of areas of news media work in need of further examination. In the second section I introduce device-centred perspectives from digital social and media research and discuss how they address the questions and possibilities opened up by digital media. After introducing these two bodies of work, in the third and final section of this chapter I discuss how the empirical chapters of my thesis were developed, my research design and case study selection.

2.1 The "Material Turn" in the Study of Journalism

2.1.1 Accounting for Materiality by Studying Digital Objects

To develop my approach to the interactions between digital objects and news work, I first turn to socio-material approaches to journalism. The first thing I take from this body of literature is a focus on accounting for the "materiality" of digital journalism. More concretely, this involves accounting for when and how digital technologies, media, objects and their features matter or make a difference in news work situations - from online newspapers (Fortunati, Taipale, & Farinosi, 2015), to interactivity and multimedia (Boczkowski, 2004a, 2004b), blogging technologies (Graves, 2007), content management systems (Anderson & Kreiss, 2013; Rodgers, 2015), application programming interfaces or APIs (Ananny, 2013), Wikipedia infoboxes and cleanup tags (Ford, 2015), hyperlinks (de Maeyer & le Cam, 2015), news site interfaces and commenting technologies (Braun, 2015), software (Usher, 2018), and email and "googleability" (Plesner, 2009).

This is perhaps not a surprising development. As news and journalism are increasingly materialised and saturated by varied first and third-party digital objects, devices and infrastructures, researchers are turning to the study of how these mundane objects participate in news work and with what consequences. Indeed, a notable special issue dedicated to journalism and materiality proposes

to take "objects of journalism" such as those listed above as a starting point for research (Anderson & de Maeyer, 2015). It argues that doing so "provides a new window into the social, material, and cultural context that suffuses our increasingly technologically obsessed world" (Anderson & de Maeyer, 2015, p. 4). Similarly, Boczkowski (2015) and Neff (2015) argue that studying digital objects and their role in news work may have implications for how the domains, actors, places and relations that make up news work are understood and conceptualised.

This growing body of work is increasingly recognised as one of the key modes of theorising and empirically studying the digital transformations of journalism (Ahva & Steensen, 2017; de Maeyer & le Cam, 2015; Lewis & Westlund, 2015; Neff, 2015). Digital transformations of news work are of course more widely discussed by journalism and media researchers outside this small STS-inspired body of work (for reviews of the larger body of work, see, e.g., Domingo, 2006; Mitchelstein & Boczkowski, 2009; Steensen, 2011). But, for me, the most interesting work comes from this smaller area associated with the material turn in journalism research, as it provides a particularly rich understanding of digital objects and technologies.[6]

Socio-material approaches in journalism, media and communication studies have been proposed as alternatives to approaches which are considered to either overestimate or underestimate the capacities of media technologies (de Maeyer, 2016; Lievrouw, 2014; Primo & Zago, 2015). On the one hand, scholars have been accused of assigning media technologies with essentialising effects and responsibility for dramatic changes. On the other hand, they have been blamed for ignoring them, treating them as neutral, or seeing them as mere by-products of interplays of pre-existing social, cultural and economic forces. These are generally known as technological determinist and social

6 Astute readers will point out that there is a longer history of attending to the materiality of media, communication and the news that extends well beyond this recent body of work and which includes well-known names, such as James Carey, Marshall McLuhan and Harold Innis. Instead of focusing on the work of these figures, I will attend to the more recent literature that adopts a "material sensibility" (de Maeyer, 2016). This is because, as we will see, this more recent research has different theoretical underpinnings, which may provide new directions and opportunities for understanding the participation of digital objects in news work.

determinist approaches to news media technologies respectively, even though these "determinisms" in themselves tend to capture the worse misconceptions about both approaches and are in need of reconsideration.[7] In relation to the former, de Maeyer (2016) has argued that:

> The (salutary) move against 'technological determinism' in media and communication studies since the 1960s (Sterne, 2014) has lead *[sic]* to a strong form of social and cultural determinism that, by the 2000s, became the dominant perspective in the field (Lievrouw, 2014: 22). (p. 461)

In relation to socio-cultural perspectives, journalism researchers taking a socio-technical perspective have for some time drawn attention to the fact that it is not just news workers' norms, practices and values that inform the performance of journalism, but also the technologies, infrastructures and material entities mobilised in this work. In relation to media and communication scholarship, Gillespie, Boczkowski, and Foot (2014a), express this point as follows:

> In communication and media scholarship, the overwhelming focus has been on texts, the industry that produces them, and the viewers that consume them; *the materiality of these devices and networks has been consistently overlooked* [emphasis added]. News, in the study of media, has been typically construed as paragraphs on a page, rather than the page itself; the headlines are examined, but not the newsboys who shout them, the teletypes that clatter them out, or the code that now renders them into clickable hyperlinks. (p. 2)

In socio-technical approaches to journalism, materiality is taken to refer broadly to the wide range of digital tools, technologies, artifacts and objects that increasingly participate in news making and often leave traces online (Anderson & de Maeyer, 2015; de Maeyer, 2016). While materiality is a complex notion interpreted differently across various disciplines, one

7 For a re-evaluation of the notion of technological determinism see, e.g., Peters (2011), who argues that the notion is "in desperate need of a critical intellectual history and reappraisal" as "it is a doctrine more often attributed than advocated". See also Peters (2017).

definition of materiality cited in journalism studies literature is that of Leonardi (2012). This definition understands materiality to refer to "the arrangement of an artifact's physical and/or digital materials into particular forms that endure across differences in place and time and are important to users" (Leonardi, 2012, p. 10). In this view the materiality of digital technologies would include the physical features of a technological artifact that matter in particular use contexts. Lievrouw (2014) makes a similar point. Whereas she defines communication technologies as the co-articulation of material artifacts and social arrangements and practices, the materiality of technologies so conceived refers to "the physical character and existence of objects and artifacts that makes them useful and usable for certain purposes under particular conditions" (p. 25).

These media and journalism researchers acknowledge that materiality has been invoked not only in relation to technological artifacts but also in relation to social and institutional practices and cultural objects (see, e.g., Boczkowski, 2015; Kreiss, 2015; Lievrouw, 2014). But the recent calls for materiality in media and news research focus on the materiality of digital artifacts at work in these domains. One of the early examples of this outlook in the context of journalism is Boczkowski's *Digitising the News* (2004a). The book took a different approach to the early literature on digital transformations of newsrooms focused on technological effects, and examined the making of early digital journalism artifacts (such as websites and web pages) by studying multiple situated appropriations of digital technologies and the professional practices, material cultures and local contingencies that shaped early newsroom experiments in online publishing. In a more recent example, Rodgers (2015) studies how a single piece of software, an in-house newsroom content management system, takes on different meanings and plays different roles across different newsroom departments. But, while studying the different appropriations of this software at these different sites, he also emphasises how the software itself shapes or forms the conditions of possibility for news work. This is manifested for example in the way in which audience metrics available through the CMS become increasingly ingrained in editorial thinking and decision making.

The attention paid to the role of objects in enacting news work is accompanied by an understanding of news and journalism as socio-technical practices (Anderson, 2015; Domingo & Wiard, 2016; Lewis & Westlund, 2015). Lewis and Westlund (2015) describe a socio-technical outlook not as a way to bring into focus how technology is impacting journalism but to foreground the ways in which organisational logics, relations and processes of news work are becoming increasingly entangled with a multitude of intersecting technological mediations and devices. The interactions between technology and news practices are understood as processes of "co-production" or "mutual shaping" (Domingo & Wiard, 2016; Gillespie, Boczkowski, & Foot, 2014b; on the notion of co-production, see also Jasanoff, 2004), even though Lievrouw (2014) believes that this remains somewhat of an "unfinished project" (p. 24).

So, while the term materiality or material turn might seem to enact a division between the study of journalism materiality or technology, and that of journalistic culture, practice, texts and history, a closer look at the body of work assembled under these labels suggests that what it in fact aspires to do is to break down these divisions and to problematise technology by examining the historical, social, cultural and political contexts in which it is being produced, transformed, appropriated and used (see, e.g., de Maeyer & le Cam, 2015). In the context of studying spam and online activist groups, Brunton and Coleman (2014) argue that a material sensibility does not involve a return to hardware and technical infrastructure as a way to get to reality. On the contrary, they argue:

> When we peel back that deepest layer of materiality, we find people and practices underneath: populations of users, and the "superusers" who operate close to the metal in their work, including system and net administrators (sys/net admins), hackers, and spammers in complex, contingent, ambiguous relationships (p. 77).

2.1.2 Conceptual and Methodological Considerations

While this body of work takes up different journalistic concerns, from technological innovation more generally (Domingo, Masip, & Costera Meijer, 2015; Micó, Masip, & Domingo, 2013; Schmitz Weiss & Domingo, 2010), to particular objects of journalism (Anderson & de Maeyer, 2015; de Maeyer & le Cam, 2015; Usher, 2018), the attention to socio-materiality that has emerged in journalism studies in the past years is perhaps most prominently associated with science and technology studies (STS) and particularly with actor-network-theory or ANT (Ahva & Steensen, 2017). ANT has been described as holding "the most fundamental implications for our analysis of journalism in the digital age" (de Maeyer, 2016, p. 463). As the name suggests, STS (and its associated ANT) emerged in the context of social studies of natural science and technology, and the socio-material approaches developed in journalism studies rely on these foundational texts (particularly the work of Bruno Latour, but also that of Michel Callon, John Law and others).[8]

Concepts and approaches from STS and particularly from ANT inform research with a socio-materiality outlook not only in journalism but also in media and communication more broadly (for a comprehensive discussion, see Gillespie et al., 2014b). In studies of journalism, ANT is typically mobilised to account for technological actants, their agential capacities, and the way they participate in the doing of journalism (Lewis & Westlund, 2015, 2016; Micó et al., 2013; Primo & Zago, 2015; Plesner, 2009; Schmitz Weiss & Domingo, 2010). The agential capacities of technologies in these studies are not seen as essentialised forces with universalised effects or consequences. Agential capacities of technologies become traceable in situated contexts of action, through associations with other actors. So technical agency is seen as different from human agency and does not refer to a sort of an independent consciousness of technical systems, but rather to the ways in which socio-

[8] While the works of Latour, Callon and Law have prominently featured in the reception of ANT in journalism studies, it should be noted that there are many others who have made seminal contributions to developing and establishing this approach whose works are deserving of more attention in relation to the study of news, including, for example, Madeleine Akrich, Cécile Méadel, Annemarie Mol and Susan Leigh Star.

technical systems facilitate, afford and constrain action.

Finally, while this approach is thriving in journalism research, it also raises methodological issues when it comes to approaching digital news work. While established work in this area is informed by ethnographic fieldwork on offline sites such as the newsroom, observation, interviews and document analysis, there is also an interest in methodological experimentation. Boczkowski (2015) argues that accounting for the participation of digital objects such as algorithms in news making will require "broadening our methodological apparatus" (p. 67). De Maeyer (2016) hints to digital traceability as one way to orient methods for studying materiality: "Digitisation shines a new light on the question of materiality by offering traces of what previously may have been gone unnoticed" (p. 461). While abandoning the newsroom and other offline sites is certainly not a useful way forward, complementing the newsroom with online sites of study, and the methodological apparatus of journalism research with methods informed by the specificities of digital devices, may be a direction worth testing given that news and information flows are increasingly being curated through digital platforms and devices. Moreover, given that the online and the offline are not separate but entangled, the online may become a way to access and characterise other sites and actors (Rogers, 2013).

2.1.3 Some Commitments and "Blind Spots" in Journalism Research

Another aspect developed in the journalism socio-materiality literature that proved useful for my research project is its discussion of commitments at work in existing approaches to journalism and what are considered to be, in the words of Pickard (2017), "blind spots" in journalism research: areas of news work in need of more sustained attention. I discuss some of these below not as a critique but in the spirit of taking up some of these concerns in my empirical work.

Recent studies emphasise the anthropocentric tendencies of journalism research, its newsroom-centrism and the emphasis on editorial work at the

expense of other areas of news work. These concerns are not only present in the journalism socio-materiality literature — on the contrary they are increasingly being raised by researchers outside this area too (see, e.g., Deuze & Witschge, 2018; Pickard, 2014; Zelizer, 2004). But in this section I will focus on discussing them in relation to this body of work that informs the research approach developed in this dissertation.

The anthropocentric tendencies of journalism scholarship refer to the dominant view of journalism practice as the domain of human actors, particularly journalists, and the scholarship's focus on the practices of this limited set of actors (Boczkowski, 2015; Lewis & Westlund, 2015; Primo & Zago, 2015). These authors argue for multiplying the types of actors acknowledged in journalism research, one the one hand towards less studied human actors (including programmers, technicians, graphic designers, project managers, marketers, sales representatives, customer relationship managers and bloggers), and one the other hand towards non-human actors or technological actants. The notion of technological actants refers to material objects that make a difference in the course of action of actors (Latour, 2005b). In the context of journalism research technological actants are described as being "inscribed and instructed by humans, socially constructed to suit journalistic, commercial, and technological purposes within news organizations" (Lewis & Westlund, 2015, p. 24). Examples of these might include: email, CMS-es, APIs, mobile applications, and algorithms. Finally, abandoning anthropocentric in favour of hybrid perspectives in journalism and media more generally, these authors argue, also involves acknowledging that human subjects might not always be at the centre of communication environments and that "there are times and places when and where we are not fully in control of our machinescapes" (Neff, Jordan, McVeigh-Schultz, & Gillespie, 2012, p. 312; see also Anderson, 2016; Primo & Zago, 2015).

Secondly, the newsroom-centrism of journalism scholarship refers to the unquestioned privileging of the newsroom as the central locus of journalism and as its site of study (Anderson, 2011b, 2016; Boczkowski, 2015; Primo & Zago, 2015). These authors argue not that the newsroom is no longer a key

locale of news work but that its place and role need to be empirically tested by examining its relationship to the wider news, media and communication ecosystem.

Finally, these studies often take issue with the way in which news and journalism research is dividing the news world into separate domains of study, or with the way in which attention is distributed across these domains (Boczkowski & Siles, 2014; Domingo et al., 2015; Domingo & Wiard, 2016; Lewis & Westlund, 2015). Lewis and Westlund (2015) draw attention to the unequal distribution of attention across the business, editorial and technological side of newsroom work, where the editorial side receives most attention. They call for a more equal emphasis on all sides and phases of newsroom work, as well as the interconnections between them (Lewis & Westlund, 2015). The business side of news work is said to be in particular need of more sustained attention (Lewis & Westlund, 2015; Pickard, 2017). Going a step further, Boczkowski and Siles (2014) argue for a "cosmopolitan" approach to the study of media, including news media, where the analytical divides between production and consumption on the one hand, and between content and material dimensions on the other would be removed in order to show the interconnections of these dimensions in practice.

2.2 Device Perspectives in Digital Social and Media Research

So far I have discussed the research sensibility towards the materiality of digital journalism that is developed by socio-technical approaches to the study of journalism, and which I draw on in the news device approach. To further elaborate this approach I turn to a number of STS-inspired device-centred perspectives from digital social and media research.[9] These approaches are

9 In this thesis I use "STS-inspired digital social and media research" not to indicate a unified research area but as a shorthand for a set of interesting and varied work that emerges at the intersection between digital social research, new media studies and STS and which informs my understanding of device-centred research approaches. My discussion of it is not meant to provide a comprehensive review but rather to capture the key aspects of device-centred

given different names, including "digital methods" (Rogers, 2013), "interface methods" (Marres & Gerlitz, 2015), "device-driven research" (Weltevrede, 2016; making an analogy with "data-driven" research), "device-aware sociology" (Marres, 2017a), and "device-centred perspectives" (Marres, 2012a). In this thesis I adopt the term "device-centred perspectives" to refer to these approaches collectively. When discussed individually I use each different name.

I draw upon these because they provide rich and nuanced approaches to the interactions between society, knowledge creation and digital media and technologies. The news device approach that I suggest channels these to help enrich the treatment of interactions between news, digital devices and ways of studying them. Drawing on these, it suggests attending both to how the digital offers sites, technologies and practices through which news work can play out, as well as to its possibilities and limits for studying both news and digital devices.

The concept as deployed in these bodies of work has a number of lineages. In STS, and particularly in ANT, the concept of device has been used to introduce objects and equipment deployed in the production of science into sociological inquiries about this topic. These objects are understood as socio-technical arrangements that serve particular purposes.[10] In their seminal *Laboratory Life,* Latour and Woolgar (1986) propose the notion of "inscription devices" to account for the work that items of laboratory equipment,

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perspectives to interactions between society and digital technologies. For broader discussions of the interplays between media studies, sociology and STS, see, e.g., Badouard, Mabi, Mattozzi, and Schubert (2016), Boczkowski and Lievrouw (2008), Gillespie, Boczkowski, and Foot (2014), Sørensen and Schubert (2015), and Wajcman and Jones (2012).

10 The notion of socio-technical arrangement, used often in this thesis in a number of variations, including heterogenous or socio-material arrangement or assemblage, is a key concept in STS and particularly in ANT. In the words of Callon (2004), "the socio-technical *agencement* is one of the central concepts of the anthropology of the sciences and technologies and, more particularly, of actor-network theory (ANT): describing a combination of human beings and technical devices that are caught in a dynamic configuration (the *agencement* acts), it emphasizes the composite and distributed character of all action and the impossibility of definitively separating humans from technologies. It is *agencements* that are primary and which give their meaning to categories such as States, markets, families" (p. 121). Understood this way, the agential capacities of devices are not the sum of the individual agencies brought together in a device but are the result of encounters between subjects and technical objects. This conception sees entities themselves as effects or outcomes of relationality (Suchman, 2014). Moreover, the notion should be thought of an ongoing "process of assembling rather than a static arrangement" (Bucher, 2012b, p. 40).

individually or in combination, do in the construction of scientific facts. Particularly inspiring for my own notion of news devices has been Muniesa, Millo and Callon's (2007) notion of "market devices". Muniesa et al. argue for including objects – such as pricing models, accounting methods, trading protocols, benchmarking procedures and financial charts – more prominently in empirical studies in economic sociology. Here market devices are not just objects that represent various economic aspects, but are understood as "material and discursive assemblages" that participate in the configuration of markets (Muniesa et al., 2007, p. 3). Similarly, news devices are digital objects of various provenances that participate in the configuration of news work in various ways. The notion aims to draw attention to how digital objects are not neutral carriers but participate in the configuration of news work by helping to render various aspects of collective life into news. For example, Chapter 3 illustrates how network diagrams help to render aspects of collective life into stories. And Chapter 5 shows how web tracking devices help to render news site visitors into audience commodities.

At the same time the notion of devices in STS draws attention to the fact that objects are inscribed with particular logics and assumptions that inform their operation: technology "both embeds and is embedded in social practices, identities, norms, conventions, discourses, instruments, and institutions" (Jasanoff, 2004, p. 3). Indeed, calling these news devices draws attention to how digital objects become implicated in news work but does not mean that they serve exclusively or primarily the purposes of journalism. The digital devices examined in this dissertation often have provenances external to the news domain and thus are inscribed with other logics and purposes. This may pull news practices that deploy them in directions that may not necessarily be entirely favourable to news institutions, as is discussed further in the empirical chapters.[11]

In this literature the notion of device is also associated with Foucault's (1980) "dispositif", often translated as "apparatus". Foucault uses this notion to

[11] For a discussion of the tensions that characterise the relations between news institutions and online platforms between short-term gains in some areas of news work versus longer-term concerns about more systemic platform dependencies, see, e.g., Nielsen & Ganter (2018).

describe shifting systems of relations between heterogenous elements "consisting of discourses, institutions, architectural forms, regulatory decisions, laws, administrative measures, scientific statements, philosophical, moral and philanthropic propositions" (p. 194). The apparatus is set in place in response to a stringent need and serves a particular strategic function, for example to control phenomena such as criminality in the case of the prison system. Heterogeneity in the context of the apparatus is meant to draw attention to its discursive and non-discursive or material composition.

These lineages inform to various degrees the digital device perspectives that I will discuss below and on which my news device approach draws. In what follows I will situate and describe these perspectives, drawing out aspects that inform my empirical work on the interactions between digital objects and news practices.

2.2.1 Digital Devices as Objects of Study

In response to early accounts of the digital that imagined it as a monolithic development with uniform, pre-determined effects, Ruppert et al. (2013) call for approaching the digital as the proliferation of varied digital media, devices and objects in specialised and mundane settings. Device-centred approaches to social research call for treating these digital devices with a sensitivity towards their "double social life" (Law, Ruppert, & Savage, 2011). This means that, on the one hand, we should explore how devices such as social media platforms, mobile applications, blogs, websites, wikis and search engines materialise social, economic, cultural and other relations in particular situations (Mackenzie et al., 2015; Marres, 2017a; Rogers, 2013; Ruppert et al., 2013; Savage, Ruppert, & Law, 2010). One the other hand, we should explore how digital devices themselves are shaped by social worlds (Langlois, McKelvey, Elmer, & Werbin, 2009). These two lines of inquiry are present in understandings of dominant online devices – e.g. Google Web Search, Facebook, Twitter and Wikipedia – as interplays between device-specific materiality, economic imperatives, social practices and cultures of use

(Weltevrede, Helmond, & Gerlitz, 2014).

Often the terms "device", "object" and "medium" are used interchangeably in these approaches. The term "device" refers not just to social media platforms but also to applications or apps, search engines and other digital media and technologies. Moreover, the term object can refer to the various elements – e.g. tags, links, tweets, likes, online profiles, date stamps – that larger socio-technical arrangements such as platforms organize. And there are of course the more mundane uses of the term device to refer to tools, gadgets or tactics.[12] Regardless of the material shape that they take, as Law and Ruppert (2013) remind us, referring to these as "devices" indicates a particular treatment as "patterned teleological arrangements", i.e. as more or less stable arrangements of heterogenous elements that do particular things. For example, the notion of news device is intended to draw attention to how news is done or performed through the interactions between journalistic work and digital objects and how the objects too are shaped through their situations of use and other social, legal and economic aspects. As I will discuss later in this section, the news device approach explores how news devices can become "research devices" by making analytical affordances of digital objects part of the research apparatus (Weltevrede, 2016).

Several materiality-sensitive research areas have emerged to attend to the specificities of digital media. In what follows I will introduce two of these that are particularly relevant for my empirical studies: software studies and platform studies. Both software and platform studies are diverse fields and both largely foreground the underlying material and technical infrastructures of digital devices and their cultural, political and economic implications. Software studies emerged in the context of growing interest in the theorisation of web and social media as spaces for cultural practices, content circulation and user participation. It responded to a concern that software, in spite of its ubiquity in today's societies, "has begun to sink into its taken-for-granted background" (Thrift, 2005, p. 153). Departing from what Bucher (2012) calls "usage studies" and the narrow focus on human activity, software studies investigates "the role

12 https://en.oxforddictionaries.com/definition/device

of software in forming contemporary culture, and cultural, social, and economic forces that are shaping development of software itself" (Manovich, 2008, p. 5). That is, software studies draws attention to the "conditions of possibility that software establishes" (Fuller, 2008, p. 2), i.e. the way in which software and protocols create the conditions of possibility for participation, sociality and knowledge. An example of a contribution to this field is Bucher's (2012) "The Friendship Assemblage: Investigating Programmed Sociality on Facebook" (2012). The article examines not how individuals use Facebook to establish and maintain friendships but rather how friendship is configured on Facebook through software actors such as the "People you may know" algorithm. This algorithm guides users in discovering new friends according to platform logics. Another software actor, the News Feed algorithm, gives more visibility to some friends than others, based on principles of similarity.

The related field of platform studies has its origins in the study of video game platforms and today extends to social media platforms. In the context of profit-driven commercial media systems, it responds to calls to investigate the interplays between the technical infrastructures of platforms and use cultures, or "the connections between platform technologies and creative production" (Bogost & Montfort, 2007, p. 1). Platform studies "highlight how platforms' affordances simultaneously allow and constrain expression, as well as how technical, social, and economic concerns determine platforms' structure, function, and use" (Plantin, Lagoze, Edwards, & Sandvig, 2016, p. 6). The aim is to explore how the material affordances of platform infrastructures shape participation, sociality, cultural production and other activities that are enacted through them. This is done by investigating platform features and objects such as user profiles, ranking algorithms, trending algorithms, social buttons, hashtags, metrics, engagement counters, APIs and so on. Researchers draw attention to programmability as a defining technical characteristic of platforms, which enables ecosystems of apps and services to emerge around them (Bogost & Montfort, 2009; Helmond, 2015a). A notable example of such a study is Gerlitz & Helmond's (2013) "The Like Economy: Social Buttons and the Data Intensive Web". The article examines how Facebook's Like button, related social plugins and the Open Graph, configure not only sociality and

participation in the platform but the very infrastructure and economy of the web, by embedding tracking devices in websites and thus enlisting websites into a "like economy", one where social engagement is of economic value.[13]

Particularly relevant for my empirical work are the concepts of "platformisation of cultural production" and "platformisation of news" that connect investigations of the technical infrastructure of platforms with their economic imperatives in the context of digital cultural production (Nieborg & Poell, 2018; van Dijck, Poell, & de Waal, 2018; see also Helmond, 2015a for the related notion of the "platformization of the web"). The concept draws attention to the increasingly dependence of digital cultural industries on big online platforms collectively known as GAFAM (Google, Apple, Facebook, Amazon, and Microsoft). It calls for empirically studying the mutual shaping of infrastructural, governance and economic mechanisms of online platforms with processes of cultural production and circulation. In such studies social media platforms are not just distribution channels for content, as the web had previously been conceptualised, but rather "articulations of technical, corporate and media logics" (Langlois & Elmer, 2013, p. 2) which seek "to establish the conditions within which content can be produced and shared and where the sphere of agency of users can be defined" (Langlois, McKelvey, et al., 2009, p. 5). Approached this way cultural objects such as YouTube videos are not just content but "thick digital objects" that enable the study of the mutual articulation of participatory culture and platform economic logics (Langlois & Elmer, 2013, p. 12).

In the context of my research work, software studies, platform studies and the platformisation of cultural production are mobilised in Chapter 4 where I examine how the code sharing platform GitHub establishes the conditions of possibility for journalism coding in alignment with its economic imperatives, and in Chapter 5 where I trace the connections between economic aspects of digital cultural production (the production of the audience commodity), and their implications for an important part of the infrastructure of news: the news

13 For more extensive reviews of software and platform studies see, e.g., Bucher, (2012b) and Helmond (2015).

website.

2.2.2 Digital Devices as Resources for Research

A second aspect that I incorporate in the news device approach and my empirical studies from digital social and media research, is the treatment of digital devices as offering modes of knowledge creation. In the previous section, I showed how digital social research, digital culture and platform and software studies scholars have drawn attention to how digital devices are increasingly performative of contemporary social life and cultural production. In this section, I turn to how digital devices also increasingly participate in the analysis of collective life and how they afford new modes of research (Marres, 2017a; Rogers, 2013; Ruppert et al., 2013; Weltevrede, 2016).

Ruppert et al. (2013) argue that "digital devices and the data they generate are both the *material* of social lives and form part of many of the apparatuses for *knowing* those lives" (p. 3), be they sociological or not. In other words, digital devices and platforms can be seen as both an object of study and as a resource for research.

Such assertions are informed by the capacities of online technologies to generate digital traces (Venturini & Latour, 2009) or "transactional data" (Savage & Burrows, 2007) about these enactments and to extensively document them in structured ways. According to Marres (2017a): "what distinguishes the digital technologies of today – what sets them apart from the 'Web' and 'information and communication technologies' (ICT) that went before – is their extensive capabilities for monitoring, analysing and informing social life" ("What is Digital Sociology?", para. 2).

Claims about the potential of digital devices to act as a resource for social research are not exclusive to and neither primarily associated with STS-inspired digital social and media research, even though the notion of "digital methods" (Rogers, 2013), which I introduce below, has gained quite some currency in

recent years. The promise of digital traceability for social research is most prominently articulated in debates about "big data" and computational social science, which explore how digital data can be used to understand human and group behaviour on a large scale (see, e.g., Kitchin, 2014; Lazer et al., 2009). This articulation of the promise of digital device data and computational methods for research has also found its way in methodological discussions in digital journalism research (see, e.g., Boumans & Trilling, 2016; Lewis et al., 2013).

STS-inspired device-centric approaches depart from this more prominent, computationally-inflected orientation towards digital data in social research, which they see as not well equipped to address essential questions raised in their disciplines, such as those regarding the mutual shaping of devices and social worlds. In the words of Marres (2017a), the limitation of this approach is

> the very framing of the object of enquiry: as long as the object of computational social science is defined as human behaviour or experience, it is not well-positioned to address – as a positive, empirical topic for digital sociology – the question of how technology, sociality and knowledge – and much else besides – interact in digital societies. ("Problems With Digital Ways of Knowing Society", para. 2)

Precisely due to the question that Marres (2017a) raises above, big data critiques have argued that digital data is biased in various ways (see, e.g., Tufekci, 2014). Device-centric approaches take questions of digital bias seriously but do not abandon devices as resources for research. Marres (2017a) suggests that digital data bias is a problem to be corrected when online data is used as a mirror or window into human and social behaviour. But for approaches that aim to account for how social action is *co-produced* with devices, how devices shape action and data becomes a vital topic of investigation ("Problems with Digital Ways of Knowing Society", para. 1-4).

As alternatives to big data approaches, device-centred perspectives develop their own ways to configure digital devices as part of the research apparatus. Marres (2017a) formulates this proposition as follows:

> Important social research methods are already built into digital infrastructures, devices and practices, even if they currently tend to serve other-than-sociological ends. I argue that it therefore is our task to test and develop the capacities of these methods-devices for social enquiry, so that they may better serve its purposes. While digital architectures constrain social research in many ways, they are also to an extent configurable: the digital application of method requires a continuous mutual adjustment of research question, data, technique, context and digital setting. ("Introduction", para. 5)

Indeed, methodological experiments under the labels of digital methods (Rogers, 2013) and interface methods (Marres & Gerlitz, 2015) have drawn attention to how "methods embedded in online devices" can be repurposed or configured for social, cultural and media research (Rogers, 2013, p. 1). This is to say that techniques of data capture and analysis inscribed in digital device features and functions which enable social life to be performed online, may be repurposed for particular types of social and media analysis. In other words, the metric-intensive and networked nature of activities and content online, through hyperlinking, likes, tweets, profile categories, tags, etc., holds, as Weltevrede (2016) puts it, particular "research affordances", i.e. it invites and facilitates particular modes of analysis. For example, hyperlinks have been used to study the "politics of association" between actors with hyperlink analysis (Rogers, 2004; Rogers & Marres, 2000), and Facebook page likes have been repurposed to examine associations between pages through "page like network" analytical techniques (Rieder, 2013).

In order to investigate the role and capacities of digital media in society, these proposals distinguish methods specific to each medium ("methods of the medium") from the use of more established social research methods such as the survey (Rogers, 2013). The positive valuation of methods native to the performance of social life with digital devices in this research programme may be seen as linked to a longer tradition in sociology to see methods for documenting and accounting for social life as always already part of everyday life (for a discussion see Marres, 2017a, "Changing Relations Between Technology, Sociality and Knowledge", para. 1-2). Digital media devices are

increasingly important actors that mediate the documentation of social life. The proposal of digital methods in the programme formulated by Rogers (2013) and the Digital Methods Initiative, of which I am a member, is to repurpose the methods by means of which social and cultural life are curated in order to understand *both* social life and the curation process.[14]

According to Weltevrede (2016), digital methods are medium-specific in the sense that they encourage a sensitivity towards the socio-material specificity of each medium, i.e. to the data, methods, objects, practices and cultures through which social life is performed in and with a particular device. Treating devices as interplays between their materiality, human actors and their cultures and practices of use (Weltevrede et al., 2014), has implications for how we draw out their capacities as research devices. When treated this way, repurposing devices for social research does not just mean using them as sources of data. It also means accounting for how these interplays enact the studied phenomenon *and* the knowledge produced about it, and devising ways to make what Weltevrede (2016) calls their "operational capacities" (e.g. the way in which they store, sort, filter and order content), as well as their use cultures, productive for social research. That is to say, the "methods embedded in online devices" – i.e. how devices such as platforms treat objects such as tweets – become at once the object of investigation *and* part of the resources drawn upon to study them (Rogers, 2013).

While the arrival of digital traceability in social sciences and humanities research reopens debates about qualitative and quantitative methods (Venturini & Latour, 2009), a qualification of digital methods along this axis does not capture perhaps the most relevant aspects of this approach. By focusing on digital devices not just as sources of data about the social but also as curating and formatting sociality and ways of knowing it, Weltevrede (2016) describes such device-driven approaches as "thick methods". Such methodological approaches call the researcher to navigate ambiguities and tensions between device provenance, resources and assumptions and the researcher's own goals through inventive configuration (Marres, 2017a; Marres & Gerlitz, 2015;

14 See https://digitalmethods.net

Weltevrede, 2016). Inventive configuration combines the formulation of research questions that allow to surface insights about the mediated issues and the mediating devices, with qualitative and quantitative analysis informed by the analytical affordances of devices, and distant and close reading of digital data sensitive to the specificities, assumptions and cultures of use of the device from which it originates.

A final point is important to be made in relation to device-centric or medium-specific digital methods approaches which I use in my empirical research. I dedicated most of the discussion in this section to explaining and situating the way in which device-centric approaches complicate the relationship between digital devices and methods. This is because this relationship is not always intuitive at first sight and it sometimes gives rise to misconceptions through association with the more dominant approaches of computational social science.

But what makes this a rich research approach is also what makes it challenging. Marres (2017a) cautions that the capacities of digital devices for social research should not be taken for granted. In the case of platforms, following the analytical affordances of the medium, which often offer metrics of frequency of occurrence (e.g. how many times a tweet has been retweeted, a post liked and so on) might pull the researcher towards forms of analysis privileged by the platform (e.g. popularity, influence and trends), and might constrain the research towards particular questions and directions. Issues of data access and data collection may further steer the research direction (for a discussion of how data collection techniques such as scraping and API calling shape research, see Marres & Weltevrede, 2013). This does not mean that digital data should be abandoned. But rather that, through the configuration of the entire research apparatus, the researcher can devise techniques to resist and push against this pull of the device and ensure that questions, device, method and data collection are all aligned. One such technique might be the move from frequency metrics to relational analysis that might reveal associational dynamics over time, such as in the case of co-hashtag analysis (Marres & Gerlitz, 2015; Marres & Weltevrede, 2013). These modifications often appear subtle. An

example of such a modification would be undertaking a qualitative exploration of the nature of public pages that engage with stories on Facebook to resist the pull of platform metrics in the direction of quantitative assessments of engagement, as was the case in another one of my studies (Gray, Bounegru, & Venturini, forthcoming). But such techniques are necessary to enable social and media research with digital devices.[15] For this reason Marres (2017a) recommends that the configurability of devices for social or media inquiry should be tested empirically rather than assumed. The trials to align the affordances of platforms with research concerns will become evident in the empirical chapters of this dissertation.

Another challenge pertains to the types of research that device-centric approaches enable. By taking digital platforms not just as sources of data but as performative of social life and methods, digital methods approaches open up two different directions of research: studying digitally curated social phenomena and studying the mediating devices themselves (Marres & Moats, 2015). The researcher can configure the research apparatus to privilege one direction over the other but this distinction may be difficult to sustain in practice as the research often does not only capture societal dynamics but also the operations of various digital media, their medium specificities and device cultures (Marres & Moats, 2015; Weltevrede, 2016). Given the inseparability of medium and phenomenon in practice this may be seen as a virtue as it opens up questions about the boundaries of research objects across disciplines (Marres & Moats, 2015).

A final risk may be seen in attending to complexities of the empirical world through the device approach. Namely that "the devices under study come to appear as all-powerful" in the configurations that they engender (Birkbak, 2016, p. 26). Moreover, by singling out particular devices for examination, the researcher may participate in stabilising their dominance and legitimating the particular ways of knowing society that they give rise to. Indeed, actor-network theory, on which the device approach draws, has been criticised for

15 For more on tactics to align the device affordances with social research questions and precautions that a social researcher needs to take when using data from digital platforms for social research, see, e.g., Venturini, Bounegru, Gray, & Rogers, 2018.

naturalising a conception of truth based on the strength of alliances that make up an "actor-network" and for being less able to account for dissenting voices that are being silenced and thus do not leave traces (see, e.g., Amsterdamska, 1990; Star, 1990; Venturini & Munk, forthcoming). However, the description of authoritative devices does not need and indeed does not follow the narrative offered by the actors themselves as the researcher aligns the research apparatus with questions informed by social and media research sensitivities (for a discussion, see also Birkbak, 2016).

Finally, as the web changes through processes such as platformisation (Helmond, 2015a), so do its methods of study. While early digital methods repurposed digital objects such as hyperlinks to examine associations between websites, today digital methods explore the research affordances inscribed in single platforms through objects such as retweets, likes and hashtags and in objects that travel across platforms such as web tracking devices (Rogers, 2017). The Digital Methods Initiative offers dozens of device specific tools, each of which incorporates a tactic to make analytical affordances of a device productive for social and media analysis. For the purposes of this research I use some of these tools and, when needed, co-developed new tools[16] and perspectives with the Initiative to approach devices that the Initiative has not previously explored (such as GitHub).[17]

2.2.3 Towards a News Device Approach

I conclude this section with a few final reflections on what might be involved in bringing device-oriented perspectives from digital social and media research to bear on the study of news work. When applying these to the study of news work practices, I refer to them as the news device approach, to draw attention to how they participate in and attend specifically to the study of digital news

16 For the set of tools developed with the Digital Methods Initiative in the context of this project to extract and analyse data from the GitHub API, see https://wiki.digitalmethods.net/Dmi/ToolDatabase?cat=DeviceCentric&subcat=Github

17 Not all research discussed in this thesis examines natively digital objects. In those cases (such as looking at networks as storytelling devices) I resort to other methods such as multimodal analysis. I will discuss multimodal analysis in more detail in the next section.

work.

While socio-material approaches in journalism studies have developed a sensibility towards studying how digital objects matter in news work, device-centric perspectives from digital social and media research further specify what a news devices research approach would look like, notably by empiricising[18] not just the object of study but also the question of method, as I will discuss below.

First, in the news device approach, the question of possible sites of study of interactions between digital objects and news work would be steered not towards offline sites where their interactions can be observed but towards the digital devices themselves. To take an example from my own work, that would be taking GitHub instead of the newsroom as a site for observing journalism coding. Secondly, the question of methods is steered towards analytical modes afforded by the digital devices implicated in organising journalistic knowledge, experience and relations. Thirdly, and perhaps most importantly, device-oriented perspectives also shape the *scope and perspective* of study. News device perspectives explore relations and practices by attending carefully to how these are inscribed, supported and enacted by digital objects. To deploy the literary notion of "focalisation", the perspective from which a narrative is presented (Bal & Lewin, 1983; Genette, 1983), device perspectives explore how relations and situations are organised and made intelligible from the perspective of digital devices. The interactions between news work and digital objects might be empirically studied by eliciting multiple accounts and diverse perspectives of what newsroom workers themselves see as meaningful interactions and what they invoke to account for these objects and interactions. A news devices approach would explore such questions by starting with the devices themselves. Here treating news empirically implies investigating how news and journalism are handled and organised by various online devices (see also

18 While empirical social research is typically driven by the question of what the actors themselves invoke to account for society or what they treat as the social in a particular situation (Marres et al., 2018; Lynch & Woolgar, 1990), in the context of device-centred research the question of method is also displaced onto the object of study, i.e. digital devices, through the move of repurposing analytical modes inscribed in the object of study.

Rogers, 2013). Following the approaches discussed above, a news device perspective would draw attention not just to how digital devices are used for journalism but would also ask how digital devices treat, process or enact various aspects of news and journalism work, how they configure the relations between news and other social domains, and what news becomes in the context of digital devices.

A news devices approach would also develop a sensitivity and reflexivity towards how these devices participate not just in news work but also in journalism research work and methods. As Marres (2012b) argues, digital research "becomes *noticeably* a distributed accomplishment [towards which] online platforms, users, devices and informational practices actively contribute" (p. 139).

The news device approach may serve as a possible direction for the methodological questions raised in relation to journalism socio-materiality approaches discussed in section 2.1. It may also gesture towards a different path for working with digital devices as resources for the study of journalism, as an alternative to more prominent computationally-inflected and/or big data research approaches.

Finally, while the research orientation sketched out in the news device perspective would favour particular sites, modes of analysis and questions, it is intended to complement (and not replace) already existing research approaches to and methods for the study of digital journalism. I aim to illustrate what perspectives are opened up by making slight modifications to how digital devices are studied in journalism, by exploring how one might address questions about sites, modes of analysis and research questions in slightly different ways, and by developing materially-sensitive ways of thinking about method.

So far in this chapter I have introduced the conceptual, methodological and disciplinary commitments that underpin the empirical work documented in this thesis and which, combined, suggest what a news device perspective to the

study of digital journalism could entail. Given that journalism is constituted through interplays of multiple devices, the question of which devices to study and how to demarcate or delineate them as objects of study becomes important. The emphasis can be variously put on different components of the devices – such as their material affordances, resulting subjectivities, ordering mechanisms, and so on – resulting in different research contributions. These considerations will be further expanded in the next and final section of this chapter, where I describe the construction of my empirical cases.

2.3 Approaching News Devices Through Case Studies

In this section I discuss some final aspects of my research design before moving onto the empirical chapters. More specifically I introduce my cases, how they were selected and developed, and how they enable me to problematise and explore the role of digital devices in various aspects of news work from a news device perspective.

The proposal for a news device approach is developed through a series of three empirical case studies examining: (1) how networks operate as narrative devices in news and what kinds of stories they tell about collective phenomena, (2) how GitHub is used as a news device but also how it configures news work as a platform asset, and (3) how web tracking infrastructures of professional and junk news sites operate as audience commodification devices. These are intended to problematise and advance understandings of the role of these devices in journalism and its study in particular ways, namely as methods for assembling news work and research in various ways.

But before going into more detail into how these cases were selected and developed, I will introduce the case study approach which I have drawn upon in this dissertation.

2.3.1 The Case Study Approach

My empirical research is organised around case studies. While case studies are used in multiple fields of research in different configurations and for different purposes, in this section I will not review the entire literature on case studies. Rather, following Beaulieu, Scharnhorst, and Wouters' understanding of case studies as "discipline-specific ways of valuing and disregarding cases" (2007, p. 674), I will focus on the approach used in my work.

Simply put, a case study is "an in-depth study of a single whole", i.e. of a whole phenomenon of the empirical world, which may be composed of multiple elements (Morgan, 2012, p. 668). The researcher's engagement with the researched topic is generally deep and nuanced and may be realised through a combination of research methods and diverse materials. This approach is also characterised by a relative open-endedness or indeterminacy of the research angle at the beginning of the study, which is to be further specified during the research process. A case study approach typically results in a thick and complex description of the studied phenomenon (Morgan, 2012).

Following Ragin (1992), I understand cases as the outcome of a process of "casing". This concept draws attention to the fact that cases do not exist "in the wild" waiting to be discovered but they are the outcome of multiple research operations by means of which concepts and empirical materials are brought in relation and become mutually constitutive, in the sense that concepts are used to reduce the complexity of the empirical world at the same time as being constantly re-articulated through empirical evidence (Ragin, 1992). The reduction of the complexity of empirical materials should not be understood as a blanket simplification but is done in order to enrich selected aspects and support selected lines of inquiry.

In the case of my research, such casing operations might include narrower ones that have to do with decisions about the boundaries of the devices I am studying and what empirical materials to collect and analyse for each case. It may also include broader theoretical casing operations, e.g., the framing of

interactions between news work and digital objects through a news device approach, that constitutes the objects of study as socio-technical arrangements and as informing the research method. The latter is an essential framing decision with important consequences in that, while it opens some lines of inquiry, it also closes others. For example, while in Chapter 5 I examine web trackers as part of the methods through which news audience marketplaces are assembled, trackers may also be constructed as an object of surveillance studies or of user privacy measures online (for an analysis of web trackers in the service of surveillance studies see, e.g., van der Velden, 2018). In the case of the GitHub repositories that make the object of Chapter 4, while I study them as objects of platformisation, they can also be constructed as cases that enable the study of collaborative software development (see, e.g., Biazzini & Baudry, 2014).

A good way to describe how the case studies developed in this thesis make empirically-informed conceptual contributions, is through the notion of problematisation. Following Beaulieu et al. (2007), in my thesis the developed cases can be described as constituting different ways of problematising various aspects of the interactions between news and the digital through different articulations of research objects, methods of investigation and empirical materials. Beaulieu et al. (2007) describe the dominant problematisation that case studies in STS develop, as enabling research accounts to express and highlight the diversity, specificity and variation of studied technologies and knowledge making practices. This problematisation emerges in response to deterministic accounts of technological development and universalising accounts of the making of scientific knowledge. This problematisation is an important part of my inquiry into how digital devices participate in news work.

Hence, I use the case study approach not for theory testing but in order to account for phenomena of the empirical world and to develop, advance, redefine or problematise concepts informed by empirical research:

> Social scientists, at various times and in various fields, have argued that case studies are not primarily vehicles for theory testing, where this is usually taken to mean testing hypothesized relationships between

> variables. And this is not because case studies are approached theory free. Rather, so it is claimed, case studies are research in the context and service of discovery, not justification: they are for the formation of evidence-based concepts, for the development of measurement structures, the places where types are defined and kinds isolated, where phenomena might be revealed and theory developed. (Morgan, 2012, p. 671)

Such work may include identifying elements of the phenomenon that are of research interest, describing key features and aspects of the phenomenon and conceptualising its functions in the social world (Morgan, 2012).

2.3.2 Selecting Digital Objects and Developing Case Studies

A number of considerations guided the selection of objects and the construction of case studies. In addition to the conceptual and methodological outlooks discussed in the previous sections of this chapter, there are also considerations related to aspects of journalistic practices examined, considerations pertaining to digital objects and case specific methodological operations. To help guide the reader through this discussion I replicate Table 1 from the Introduction below.

Area of news work	Making narrative and storytelling	Making infrastructure and coding	Making audience
Digital object	The network graph	The coding platform	The web tracker
News device	The network as storytelling device	GitHub as connective coding device	The tracker as audience marketplace device

Table 1 (duplicate of table in introduction): Types of news work, digital objects and news devices examined in this dissertation.

From the point of view of aspects of news work covered, the thesis covers: narrative making through storytelling, infrastructure making through coding, and audience making through commodification (see Table 1). The thesis starts

in the terrain of journalistic representations, namely news and investigative stories. News stories are the most familiar, visible and accessible aspect of news work, intended to reach a wide public. Storytelling is also an aspect of news work that is regularly discussed by journalism researchers and journalists alike. Starting the empirical work with this aspect of journalism practice I think is a good way to introduce readers of this dissertation to the proposed approach, at work on a topic that is familiar and of wide interest. However, in the spirit of Becker's (1982) proposal for a sociology of art that expands the analytical frame beyond the artists and the familiar art works themselves to the wider networks of relations and practices though which they are produced and circulated, the next two empirical cases studies move towards less visible aspects of news work, namely coding and audience making. These two cases are also a response to calls that emerge in the journalism socio-materiality literature to give more sustained attention to particular aspects and areas of journalism practice.

As indicated in in section 2.1, these authors argue for approaches that emphasise things other than what they call "human-centric considerations" (Lewis & Westlund, 2015), and that explore the spatiality of news work by taking locales other than the newsroom as a site of study. For these reasons, when approaching coding, the second aspect of news work examined in this thesis, I have not focused on journalism-coders and the impacts of their work on the editorial side of news work, but on the code work itself, as available in public code repositories on the social coding platform GitHub. While the focus on code repositories of news organisations on GitHub might be seen as a reassertion of the newsroom as the main locale for news work, as the chapter will illustrate, changing the site of study provides an opportunity to re-situate the newsroom as a locale for news work. As journalism code work relies on distributions of code and contributions of participants from myriad places, it may be seen as a decentralisation of journalistic production away from the newsroom. At the same time, as the chapter points out, collective journalism code work is being recentralised outside the newsroom, on a code-sharing platform, thus complicating the critique of newsroom-centricity by adding the equally critical dimension of platform-centricity of news work.

The third empirical case investigates a less visible aspect of news work, namely the audience product. While research on the role of technology has focused mainly on the editorial sides of news work (Lewis & Westlund, 2015), in this third empirical case I focus on the role of digital objects in the business side of news work, and in assembling relations between the news industry and the digital marketing and advertising industries. The economics of news work and its relationship with the news and advertising industries have been indicated as one of the blind spots of digital journalism research (Pickard, 2017). By treating journalism as a form of digital cultural production and treating its audience marketplaces alongside those of other forms of digital content production, junk news, I am to explore what is specific to audience marketplaces of the news industry compared to other forms of digital content production. According to Boczkowski and Mitchelstein (2017), "which empirical trends are unique to online news and which ones might be shared across other domains of digital culture" (p. 17), is an important question to address. Moreover, the "fake news" scandal can be taken as an occasion to understand news as a socio-material practice that is articulated not only through the interplay between news and digital technologies as I have emphasised so far, but also in relation to other digital content producers.

From the point of view of socio-material devices, I examine three objects that participate in news work: network graphs, GitHub, and third-party web trackers. The empirical cases test digital news devices not only for their capacities to shape news work but also for their implications for the relations between different domains that news configures. Here I draw on Gillespie et al.'s (2014a) understanding of news media "not merely as messages that affect minds, but as social relations by other means" (p. 2). I also draw on Marres (2017a) who argues that it is important to trace not just the implications of digital devices for particular fields such as that of news and journalism, but to also trace how digital devices reconfigure or co-articulate relations between different social "domains", such as journalism, advertising industries, policy, computer science, data intermediary industries, and so on. Indeed, in the chapters that follow I explore how digital devices configure not just news

processes but also relations between news and other areas, from digital visual culture, to commercial online platforms, other digital content producers and the online advertising and marketing industries.

My approach to these objects and my construction of cases is also guided by calls from journalism materiality researchers to make journalism research relevant to other disciplines (Boczkowski & Mitchelstein, 2017). I do this by configuring my cases to address both implications for news and journalism and its relations with other domains, as well as to understand the digital devices themselves and how they might affect other practices.

I focus on network diagrams because over the past couple of decades, networks have become an increasingly popular way to represent all kinds of collective phenomena. But while the analytical properties of networks have received much attention (see, e.g., the area of graph theory), the narrative affordance of networks are just beginning to be explored. Studying what network diagrams contribute to journalistic stories draws attention to the narrative affordances of networks, particularly given that journalism can be taken as exemplary form of storytelling.

The second digital device examined is the code platform GitHub and how it treats public journalism code repositories. I focus on GitHub because while it is the largest online code hosting service and has received a lot of attention particularly from researchers in computer and information science and software engineering, it has been less studied in digital sociology and critical platform and software studies. By taking a device approach to the GitHub platform I aim to contribute to platform studies by developing a device-approach to understanding GitHub's platform-making processes.

The final digital object is third-party web tracking infrastructures of news industry websites and junk news sites. I focus on web tracking because this is an essential but often overlooked aspect of journalistic audience making online. Web tracking is one of the core mechanisms through which the economic model of digital businesses is being materialised. Web trackers are snippets of

third-party code embedded in news websites through which data flows are being established between media organisations, digital platforms, advertisers and other third parties, and through which the monetisation and platformisation of news being materialised. In doing so, I aim to contribute not only to media audience studies by connecting the economic underpinnings of news with its digital infrastructures, but also to infrastructural approaches to new media studies by developing the concept of trackers as audience marketplace devices in the context of news websites.

Another way to distinguish between these cases is in terms of the aspects of the device perspective, the conceptions of the digital that they articulate and the methods used. The first object, network diagrams, is a digitised one, in the sense that it is not native to the digital but rather it is a pre-digital material object that has migrated to digital media (for more on the distinction between natively digital and digitised objects, see Rogers, 2014). While network diagrams are prominently associated with online visual culture and online phenomena such as the web or social networks, these are underpinned by earlier social scientific concepts and methods such as those of social network analysis (Marres, 2017a). GitHub and web trackers may be considered natively or born digital media and objects, in that they are specific to the medium (Rogers, 2014), although these too are underpinned by established social scientific traditions, as Marres (2017a) cautions. Another consideration that informs my selection of web trackers as the final digital object is Langlois, McKelvey, et al.'s (2009) call for "a move beyond, and below the user interface" (p. 8), in the sense of approaching the digital not just through the visual aesthetics and the representations made available through the user interface but also through less visible digital objects.

Finally, the methods I use follow from the way in which the interactions between the three digital objects and the three aspects of news work are problematised through conceptual approaches, research questions and research angles.

In the case of the interactions between network diagrams and journalism

storytelling, the problematisation revolves around the narrative potential or affordances of network graphs in their original contexts of publication, journalistic articles or multimedia projects. To address the question of how these objects shape journalistic stories about collective phenomena, I use multimodal analysis on a collection of journalism pieces of different genres. Multimodal analysis is an established approach to the study of communicative texts that makes use of multiple modalities, such as graphics and written language. More formally, it refers to analytical approaches "that understand communication and representation to be more than about language, and which attend to the full range of communicational forms people use – image, gesture, gaze, posture and so on – and the relationships between them" (Jewitt, 2009a, p. 14). Given the particular focus of this chapter on networks diagrams, I also draw on insights from graph semiotics as developed by Bertin (1983), to understand how narrative readings are cued by visual properties of graphs and construct meaning from them. This method is discussed in more detail in Chapter 3. This case is device-driven in the sense that the focus is on the narrative readings cued by network graphs. Given that it does not deal with a natively digital object, the case is constructed around illustrating the device perspective with focus on the device as an object of study, and less on the device as part of method.

In the second and third cases, the devices are not just an object of study but also a methodological entry point, in that the analytical capacities inscribed in the way in which they network content, are taken as a way of knowing this content by using medium-specific digital methods (Rogers, 2013). In other words, digital devices and the traces they generate and make available, are an important source of empirical material for my analyses. In the case of the interactions between journalism coding and GitHub, the problematisation revolves around how the platform shapes journalism code and how the participation of news initiatives in the platform may be described. These problematisations are approached with a combination of methods. These include methods in software and platform studies such as interface analysis, the analysis of platform documentation such as help pages and the platform development blog, as well as tech press documenting the platform

development. They also include repurposing the platform's own methods for curating platform activities and data. This includes repository creation and update date stamps, popularity metrics and collaboration metrics. The data is collected by calling a particular end point of the GitHub API through a set of scripts developed with the Digital Methods Initiative for the purpose of this project. API calling is an increasingly common technique in digital social and media research to automate the retrieval of data from social platform APIs (Marres & Weltevrede, 2013). The studied corpus is demarcated through an expert list of news initiatives that hold a GitHub account. The method is described in detail in Chapter 4.

In the case of the interactions between third-party web trackers and mainstream and junk news sites, the problematisation revolves around the configuration of third-party web tracking infrastructures as audience marketplace devices. The aim is to explore how audience commodification can be approached from a digital device perspective. The method used in this chapter consists in repurposing the detection and classification capacities of the popular privacy protection browser extension Ghostery to identify the tracking signatures present in the source code of a collection of web pages from mainstream and junk news sites. This is done with the help of the Tracker Tracker tool developed by the Digital Methods Initiative. This can be seen as a form of cross-platform analysis that focuses on digital objects embedded in websites that create connections with third parties (Helmond, 2017; Rogers, 2018). Visual network exploration with the tool Gephi is then used to examine the presence of trackers in this set of websites and the tracking networks in which websites are embedded. Visual network exploration is a visual analytical technique that translates network structures into visual properties of network graphs to facilitate their visual exploration and interpretation (Venturini, Jacomy, & Pereira, 2015).

As discussed above, these case studies were configured to foreground and make available for analysis particular aspects: how networks shape narratives, how GitHub treats journalism code, and how audience marketplaces are configured and understood through the tracking infrastructures of websites. I

constructed these different case studies in order to attend to the diversity and specificity of the different ways in which the digital counts or makes a difference in news work: as visual culture and visualisation objects, as online platforms and as web infrastructure, as well as to illustrate different methods for studying them. By taking an orientation towards materiality, diversity and specificity of interactions between digital objects and news work, I aim to provide more nuanced accounts of how the digital participates in news and journalism. By illustrating a number of methodological approaches, I aim to develop means for such investigations to be conducted in the future.